

MS 6/27/88

OAK RIDGE NATIONAL LABORATORY

OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.

POST OFFICE BOX 2008
OAK RIDGE, TENNESSEE 37831

June 17, 1988

Mr. Robert W. Barber
Director of Operational Safety, EH-34
Office of Environment, Safety, and Health
U.S. Department of Energy
Washington, DC 20545

Dear Mr. Barber:

Enclosed are hard copies of the materials we sent you last Friday by facsimile. I am in the process of confirming several numbers that are shown in the listings as being uncertain. My finance officer was away on military leave last week but I think the numbers are reasonably accurate. I will confirm some of the uncertain values with Dr. Irazo in Spain.

The information I sent you does not include funding for capital equipment. In 1980, I was asked by DOE Headquarters to assist the DOE in providing assistance to the Spanish government for this program. ORNL has been funded through field task proposals since that time to work with the Spanish. The details of this support are contained in proposals on file with ES&H. Please let me know if you would like a copy of the most recent proposal. The requested funding has been used for items such as equipment used in Madrid and Palomares, radioactive sources and standards, the preparation of special reports, and the development of excretion models. We have received no funding for this purpose for FY 1988. We have, however, outstanding commitments for materials being prepared for the Spanish and we will be able to use some carryover funds for this purpose in FY 1988. It is important that some funds be made available for the coordination of activities and support of the work being done in Spain.

I also need to point out to you the importance of someone in the DOE talking to the Spanish about the future of U.S. funding for Project Indalo. The frustration level is very high and the Spanish do not understand why the DOE has not funded them for the current year or the previous year without the benefit of any discussions on the subject. I have discussed the situation with individuals within DOE for the past several years and I have pointed out that the situation is becoming very critical. I am not able to help the Spanish on this point. Ignoring the problem will not make it go away.

Much useful data has come from this accident and there is still much information to be obtained. One of the items of information I sent you last week is a summary of some key questions that were asked by Tom McCraw. I provided answers to these questions and I think a careful review of that information will help determine the future needs and perhaps duration of support to the Spanish for this important project. I never received any feedback on our response to McCraw's questions.

Please let me know if you need additional information. I would be most pleased to brief you in more detail on this subject at your convenience.

Sincerely,

Chester R. Richmond
Chester R. Richmond
Associate Director

CRR:bwd

Enclosures

cc/enc: V. B. Isham
File - NoRC

LIST OF ENCLOSURES

Letter to Mike Marelli and Listing of Key Questions

Plutonium Contamination Twenty Years After the Nuclear Weapons Accident in Spain, E. Iranzo and C. R. Richmond

Air Concentrations of ^{239}Pu and ^{240}Pu and Potential Radiation Doses to Persons Living Near Pu-Contaminated Areas in Palomares, Spain, E. Iranzo, S. Salvador, and C. E. Iranzo, Health Physics, Vol. 52, No. 4 (April), pp 453-461, 1987.

Budget Information

OAK RIDGE NATIONAL LABORATORY

OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37831

October 9, 1987

Mr. Mike Marelli
Health Physics Branch
Office of Nuclear Safety
EH-331.2
U.S. Department of Energy
Washington, DC 20545

Dear Mr. Marelli:

I am responding to the January 15, 1987 letter from Tom McCraw concerning Project Indalo. I believe we are now in a position to arrange for a review covering the items listed in Tom's letter. There have been numerous interruptions in the work at Palomares because of the construction of a large reservoir in the area, curtailment of funding by the DOE, and civil discussions concerning the project that were prompted by the twentieth anniversary of the accident. The latter item involved concerns that indemnification claims would not be possible after 1986.

I had discussions with Dr. Iranzo in August during the International Congress on Radiation Research meeting in Edinburg and we feel that some approximations can now be made concerning the last question in McCraw's letter. I am providing you with a draft response to McCraw's letter. Following the receipt of your guidance, I will either convene the advisors to meet and discuss the recommendations or solicit their written comments before formally transmitting them to you.

I have attached the letters I received from the advisors following our last meeting which was held in October, 1985. You will note the strong statements in support of Project Indalo. I have also included copies of the publications mentioned in this report.

Please call if you have questions or need additional information. I personally appreciate your interest in this important program.

Best personal regards.

Sincerely,



C. R. Richmond
Associate Laboratory Director for
Biomedical and Environmental Sciences

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Attachments

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ATTACHMENT 1

ANSWERS TO QUESTIONS POSED BY TOM McCRAW

What are the potential health effects for people in the area? In particular, what is the situation for the individuals with the highest committed effective dose equivalents?

The potential health effects are considered to be small. We have several reports that document the best current estimates of the radiation dose to people at several locations at Palomares. These numbers are contained in the following publications attached to this report:

1. Iranzo, E., Salvador, S. and Iranzo, C. E. 1987. Air Concentrations of Pu-239 and Pu-240 and Potential Radiation Doses to Persons Living Near Pu-Contaminated Areas in Palomares, Spain. *Health Physics* 52 (4): 453-461.

2. Iranzo, E. and Richmond, C.R. 1987. Plutonium Contamination Twenty Years After the Nuclear Weapons Accident in Spain. Presented at the 8th International Congress on Radiation Research meeting, Edinburgh, Scotland, August, 1987.

Results for chest counting of low-energy X-rays indicate no internally deposited Pu above the minimum detectable level which is about 22 nanocuries (814 Bq). Estimates of radiation dose based on presumed inhalation levels calculated from air sample measurements over a 15 year period show small committed effective dose equivalents (Ref. 1, p. 4). The values are probably conservative in that it was assumed that all the Pu measured on the filters was inhaled as one micron diameter particles. No corrections were made for the Pu originating from fallout from weapons tests in the atmosphere that was also collected on the filters. Air concentrations of Pu in the village were about the same as those measured for the same time period in New York City and in Northern Italy (Ref. 2, P. 3). Air concentrations in the most contaminated areas at Palomares were higher than those in the village resulting in committed effective dose equivalents about ten times higher.

Bioassay data also suggest that the majority of those people measured have small, if any, estimated radiation doses. These values are subject to change as more data are collected. We are currently beginning to assess the possible contribution to total radiation dose from Am-241. Table 8 in Reference 2 suggests that 54 of 646 people may have positive measurements for Pu in urine. Ten of the 646 people measured could have estimated committed effective dose equivalents as large as 100-200 mSv (10-20 rem).

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There is also a report from Spain (not the JEN) concerning the mortality in Palomares and a control village (Guazamara) for the period 1946-1985. The death rate from cancer does not appear to be higher in Palomares but this study may not be reliable and should be interpreted with caution. I sent this material to DOE earlier this year.

How similar is the contamination at Palomares to other areas contaminated with Plutonium?

A comprehensive study of the levels of fallout Pu in air and in soil was undertaken so that comparisons could be made between Palomares and other locations. This material is contained in the following report.

3. Holleman, J. W. et al. 1987. Worldwide Fallout of Plutonium from Nuclear Weapons Tests. *ORNL-6315*, 288 pps.

Annex I of a 1981 report briefly discussed many of the known cases of environmental plutonium contamination. The reference is:

4. The Environmental and Biological Behaviour of Plutonium and Some Other Transuranium Elements. 1981. NEA Group of Experts. Organisation for Economic Co-operation and Development, Nuclear Energy Agency. pps. 75-86. I was a co-author of this report.

We have recently established contacts with Australian personnel involved with the Maralinga site. It appears that there are significant differences in particle size and activity distributions between Palomares and Maralinga. We will continue discussions and data exchanges with the Australians.

It is difficult to make comparisons among and between these sites. For example sites some represent primarily surface contamination whereas others, such as parts of Palomares, represent cultivated areas where the contamination has been distributed deep into the soil.

Is there any problem with the food crops grown in the area?

We do not believe the food crops are a problem. We have estimated the radiation dose to people from this source and believe it to be trivial (Ref. 2, p. 3). We have surveyed the literature and produced a report documenting the levels of naturally occurring alpha-emitting radionuclides in various foods grown at different locations around the world. This information can be used for comparative purposes for those situations where, on occasion, a small amount of radioactivity may be detected in food products grown in Palomares.

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5. Drury, J. S. et al. 1983. Radioactivity in Food Crops. *ORNL-5963*. 321 pps.

Is the current effort adequate?

No. Funding for the investigators in Spain has been delayed for the past several years causing scheduling and other problems. Funding for the year starting February 1987 has yet to be received. Morale is bad among the Spanish personnel and they are, for the first time to my knowledge, questioning the intent of the DOE to meet its obligations under the Hall-Otero agreement.

Should further remedial action be taken?

A final answer to this question cannot be given at this time. We can, however, offer our best current assessment of the situation. To do so, we used several approaches.

Our best current estimate is that there is about 4 Ci Am-241 in the cultivated portions of areas 2-0 and 2-1. In addition, there is about 0.38 Ci Am-241 in the non-cultivated parts (fields) of areas 2-0 and 2-1. The Pu/Am ratio for these locations is about three, thus the estimated Pu-239 activities are 12 Ci and about 1 Ci for the cultivated and non-cultivated areas, respectively, for a total of approximately 13 Ci Pu-239. The cultivated area is about 38,077 square meters (3.8 hectares). The non-cultivated area is about 28,500 square meters (2.85 hectares). We now believe that cultivating the land in these areas in recent years has spread activity that was buried after the accident.

We have also made an estimate of the total residual radioactivity based on the original estimates of contamination. This estimate is about 8.7 Ci Pu-239. The following table summarizes the information used for this estimate. Please note that "segment" is a new term that roughly corresponds to the original contamination isopleths at Palomares.

<u>Segment</u>	<u>Hectares</u>	<u>Acres</u>	<u>kBq/m²</u>	<u>Ci Pu-239</u>
A	2.2	5.4	>1200	Not known
B	17	42.0	120-1200	5.51
C	87	215.0	12-120	2.82
D	120	296.5	<12	0.39
Total	226	559	—	8.72

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It should be noted that the highest levels, >1200 kBq/square meter, were removed and shipped to the U.S. This represents 2.2 hectares. The analysis also assumes that the upper end of the range exists at each location.

Thus, the residual Pu-239 contamination in areas 2-0 and 2-1 (13.2 Ci) plus the activity originally estimated for the remaining locations (8.7 Ci) total 21.9 Ci.

We have made a similar calculation based on the results of the soil sampling program conducted at Palomares since the accident. The results are as follows:

SEGMENT	PARCELS	AVERAGE Pu-239 (Ci)
A	Originally removed	Not known
B	2.2, 3.1, 3.2	5.12
C	5.1, 5.2	3.56
D	Remainder	0.48
	TOTAL	9.28

It should be noted that the activity in the remainder was assumed to be 10% of that in segment B (the total area for segment C is larger than that for segment B).

Thus, the total inventory at Palomares as estimated by two approaches gives values in the range of 20-25 Ci Pu-239. This does not include the unknown amount removed in 1966 and shipped to the Savannah River site. Of this total, about 13 Ci may be concentrated as follows:

- 12.06 Ci distributed over 3.8 hectares (9.4 acres) down to 45 cm but very non-uniformly.

- 1.14 Ci distributed over 2.85 hectares (7.0 acres) down to about 5 cm.

It is recommended that when these estimates of residual Pu are refined, the DOE should initiate discussions with the appropriate Spanish authorities concerning possible remedial actions.

In this case, the residual Pu-239 contaminations in areas 2-0 and 2.1 (13.2 Ci) plus the 9.3 estimated for the rest of the contaminated land (based on soil sampling) total 22.5 Ci.